

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

**Applicant:** Alexander Brockhoff

**Serial No.:** 08/938,173

**Filed:** 9/26/97

**Title** Method and Device for Removing Gas ...

**Group Art Unit:** 1723

**Examiner:** S. Kim

**Attorney Docket No:** 1267

Date of Deposit: 8/24/98

I hereby certify that this paper is being deposited with the United States Postal Service, with sufficient postage, as first class mail, in an envelope addressed to the Assistant Commissioner for Patents, Washington D.C. 20231:

Signature: Stephanie J. Smith

Printed Name: Stephanie J. Smith

**TRANSMITTAL LETTER**

Assistant Commissioner for Patents  
Washington, D.C. 20231

Dear Sir:

Enclosed for filing with the United States Patent and Trademark Office in the above-identified matter are the following documents:

- Information Disclosure Statement (9 pages)
- Form PTO/SB/08A (3 pages)
- Copies of references
- Fee Transmittal Form
- Check in the amount of \$240
- Post Card

Respectfully submitted,  
KEVIN BUSINESS CORPORATION  
By its attorneys:

Date: 8/24/98

Stephanie J. Smith  
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PTO/SB/17 (2/98)  
Approved for use through 9/30/2000. OMB 0651-0032  
Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

# FEE TRANSMITTAL

Patent fees are subject to annual revision on October 1.  
These are the fees effective October 1, 1997.  
Small Entity payments must be supported by a small entity statement,  
otherwise large entity fees must be paid. See Forms PTO/SB/09-12.  
See 37 C.F.R. §§ 1.27 and 1.28.

TOTAL AMOUNT OF PAYMENT (\$ ) 240

## Complete if Known

Application Number 08/938,173  
Filing Date 9/26/97  
First Named Inventor Brockhoff  
Examiner Name J. Kim  
Group / Art Unit 1723  
Attorney Docket No. 1267

## METHOD OF PAYMENT (check one)

1. ☐ The Commissioner is hereby authorized to charge indicated fees and credit any over payments to:

Deposit Account Number   
Deposit Account Name   
☐ Charge Any Additional Fee Required Under 37 C.F.R. §§ 1.16 and 1.17 ☐ Charge the Issue Fee Set in 37 C.F.R. § 1.18 at the Mailing of the Notice of Allowance

2. ☒ Payment Enclosed:  
☒ Check ☐ Money Order ☐ Other

## FEE CALCULATION

### 1. BASIC FILING FEE

Large Entity Fee Code (\$)	Small Entity Fee Code (\$)	Fee Description	Fee Paid
101 790	201 395	Utility filing fee	
106 330	206 165	Design filing fee	
107 540	207 270	Plant filing fee	
108 790	208 395	Reissue filing fee	
114 150	214 75	Provisional filing fee	
SUBTOTAL (1) (\$)			

### 2. EXTRA CLAIM FEES

Total Claims  -20\*\* =  X  =   
Independent Claims  -3\*\* =  X  =   
Multiple Dependent  =

\*\*or number previously paid, if greater; For Reissues, see below

Large Entity Fee Code (\$)	Small Entity Fee Code (\$)	Fee Description	Fee Paid
103 22	203 11	Claims in excess of 20	
102 82	202 41	Independent claims in excess of 3	
104 270	204 135	Multiple dependent claim, if not paid	
109 82	209 41	** Reissue independent claims over original patent	
110 22	210 11	** Reissue claims in excess of 20 and over original patent	
SUBTOTAL (2) (\$)			

## FEE CALCULATION (continued)

### 3. ADDITIONAL FEES

Large Entity Fee Code (\$)	Small Entity Fee Code (\$)	Fee Description	Fee Paid
105 130	205 65	Surcharge - late filing fee or oath	
127 50	227 25	Surcharge - late provisional filing fee or cover sheet.	
139 130	139 130	Non-English specification	
147 2,520	147 2,520	For filing a request for reexamination	
112 920*	112 920*	Requesting publication of SIR prior to Examiner action	
113 1,840*	113 1,840*	Requesting publication of SIR after Examiner action	
115 110	215 55	Extension for reply within first month	
116 400	216 200	Extension for reply within second month	
117 950	217 475	Extension for reply within third month	
118 1,510	218 755	Extension for reply within fourth month	
128 2,080	228 1,030	Extension for reply within fifth month	
119 310	219 155	Notice of Appeal	
120 310	220 155	Filing a brief in support of an appeal	
121 270	221 135	Request for oral hearing	
138 1,510	138 1,510	Petition to institute a public use proceeding	
140 110	240 55	Petition to revive - unavoidable	
141 1,320	241 660	Petition to revive - unintentional	
142 1,320	242 660	Utility issue fee (or reissue)	
143 450	243 225	Design issue fee	
144 670	244 335	Plant issue fee	
122 130	122 130	Petitions to the Commissioner	
123 50	123 50	Petitions related to provisional applications	
126 240	126 240	Submission of Information Disclosure Stmt	
581 40	581 40	Recording each patent assignment per property (times number of properties)	
146 790	246 395	Filing a submission after final rejection (37 CFR 1.129(a))	
149 790	249 395	For each additional invention to be examined (37 CFR 1.129(b))	
Other fee (specify) _____			
Other fee (specify) _____			
SUBTOTAL (3) (\$)			240

## SUBMITTED BY

Typed or Printed Name Stephanie J. Smith

Signature

*Stephanie J. Smith*

Date

8/24/98

## Complete (if applicable)

Reg. Number

34,437

Deposit Account User ID

PATENT



U.S.S.N. 08/938,173

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

**Applicant:** Alexander Brockhoff

**Serial No.:** 08/938,173

**Filed:** 9/26/97

**Title:** Method and Device for Removing Gas from Gas-Containing Blood

**Group Art Unit:** 1723

**Examiner:** S. Kim

**Attorney Docket No:** 1267

Date of Deposit: 8/24/98

I hereby certify that this paper is being deposited with the United States Postal Service, with sufficient postage, as first class mail, in an envelope addressed to the Assistant Commissioner for Patents, Washington D.C. 20231:

Signature:

Printed Name: Stephanie J. Smith

Assistant Commissioner for Patents  
Washington, D.C. 20231

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**INFORMATION DISCLOSURE STATEMENT**

Dear Sir:

In connection with the examination of the above-identified application for patent, please consider the references listed on the attached PTO Form 1449 and discussed below.

U.S. Pat. No. 3,715,863 to Zanoni describes a pump/air separator apparatus for use in dispensing gasoline which includes an air separator of the cyclone type.

U.S. Pat. No. 3,753,336 to Drew et al. describes a centrifugal separation apparatus for separating entrained liquids and solids from a gaseous stream containing entrained liquids and solids.

U.S. Pat. No. 3,771,290 to Stetham describes a vortex type de-aerator for separating air and other gases from a flowing liquid.

U.S. Pat. No. 3,812,655 to Bennett describes a device for separating a gas from a liquid by centrifugal force and the buoyancy of the gas, the device having an inlet tangentially disposed to a cylindrical receptacle.

U.S. Pat. No. 3,833,013 to Leonard describes a bubble trap for a fluid flow line.

U.S. Pat. No. 3,912,468 to Tsuchiya et al. describes an air bubble separating device incorporating a control plate positioned to generate a vortex flow.

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U.S. Pat. No. 3,994,689 to DeWall shows a bubble oxygenator having a bubble chamber including a mesh framework for eliminating bubbles.

U.S. Pat. No. 3,996,027 to Schnell et al. describes a device for separating low density materials such as gas bubbles from a liquid, the device including a liquid inlet port arranged to create swirling flow about a chamber. Bubbles migrate toward the center of the swirling flow and rise therefrom.

U.S. Pat. No. 4,053,291 to Sims describes an oil deaerator having an entrance tube with holes to allow air to escape.

U.S. Pat. No. 4,054,522 to Pinkerton describes an apparatus for exposing a fluid to a negative pressure for degassing liquid. The apparatus includes a receptacle with a partition reciprocable therein and dividing the cylinder into two chambers. By changing the volume of the chambers, a negative pressure is created and bubbles are extracted.

U.S. Pat. No. 4,061,031 to Grimsrud describes a flow meter and bubble trap for blood. Flow rates and direction are such that bubbles efficiently rise out of the liquid.

U.S. Pat. No. 4,093,428 to Swogger describes a gas/liquid separator for separating entrained gases such as air from liquid such as oil in hydraulic systems. Centrifugal force is imparted to a liquid causing gas bubbles to collect in the center of the chamber. High density liquid is discharged while liquid with entrained gas bubbles is urged centrally upward into a second chamber where further separation occurs.

U.S. Pat. No. 4,102,655 to Jeffery et al. describes a bubble trap using flow rates to encourage bubble to efficiently rise to the top of a container.

U.S. Pat. No. 4,247,309 to Buddenhagen describes a process and apparatus for the separation of gas bubbles from a liquid under flow, incorporating an arcuate wall to induce a vortex in the flow and using buoyancy to cause the bubbles to separate from the liquid.

U.S. Pat. No. 4,282,016 to Tauber et al. describes an apparatus for removing entrapped gas in an oil lubrication system. Centrifugal force is imparted to the fluid flow to cause entrapped gas to coalesce in the center of the flow pattern and from which point it can be vented from the system.

U.S. Pat. No. 4,316,271 to Evert describes an electrostatic transducer having a bubble trap and a vent for extracting gaseous bubbles from the fluid fill.

U.S. Pat. No. 4,344,777 to Siposs describes an arterial blood filter for extra-corporeal bypass. It has an internal divergent blood flow path from the inlet to smoothly reduce blood flow velocity to permit separation of air bubbles with minimum trauma to blood cells.

U.S. Pat. No. 4,345,919 to Wilkinson et al. describes a device and method for use in medical transfusion or bypass circuits wherein biological fluids such as blood are introduced into a cylindrical cavity in a vortical flow such that gas bubbles are separated from the fluids by being forced toward the center of the chamber and buoyed upward.

U.S. Pat. No. 4,360,428 to Comparetto et al. describes a device for separating particles from a fluid by the interplay of centrifugal, centripetal and gravitational forces in an inverted fluid vortex.

U.S. Pat. No. 4,368,118 to Siposs describes a blood-air separator for use in the extracorporeal blood bypass during cardio-pulmonary surgery. Air bubbles are separated from recirculating blood stream by centrifugal force and buoyancy after the stream has left the oxygenator and before it returns to the patient. Separation is accomplished by imparting circular motion to the bloodstream within the separator at a point where air bubbles can move upward and inward and blood liquid outward and downward.

U.S. Pat. No. 4,394,138 to Schilling describes a centrifugal separator for the separation of the liquid and gaseous phases of a mixture thereof whereby gas is drawn to the center of the chamber and is buoyed upward.

U.S. Pat. No. 4,433,971 to Lindsay et al. describes a bubble trap in a cardioplegia system using buoyancy to draw bubbles upward from the liquid.

U.S. Pat. No. 4,474,184 to Harui describes a bubble trap for use with an ultrasonic scanhead that uses buoyancy to draw bubbles upward from the liquid. Bubbles are allowed to rise and escape regardless of the orientation of the scanhead.

U.S. Pat. No. 4,475,932 to Hull et al. and its continuation U.S. Pat. No. 4,555,253 to Hull et al. describes a closed liquid circulating system incorporating a device for removing the gas

having upper and lower chambers and is arranged to induce vorticular flow in the incoming fluid which causes gas to be drawn to the center of the flow and to be drawn upward by buoyancy.

U.S. Pat. No. 4,585,465 to Suzuki et al. describes a method for causing bubbles in a fluid to coalesce using a vortex flow and buoyancy.

U.S. Pat. No. 4,690,762 to Katsura describes an apparatus for removing bubbles from a liquid such as blood, the apparatus arranged to induce vortex flow in a vessel to cause bubbles to be drawn inward and using buoyancy to draw the bubbles upward toward a gas outlet.

U.S. Pat. No. 4,749,387 to Lotz describes a separator for solid particles entrained in a gas flow using vortex flow to increase path length and using gravity to draw particles out of the liquid in a vessel.

U.S. Pat. No. 4,806,135 to Siposs describes a bubble trap using vortex flow and buoyancy to draw bubbles inward and upward to separate them from the liquid.

U.S. Pat. No. 4,860,591 to Garland describes an apparatus for subjecting a gas-liquid mixture in a dynamic flow regime to a vortical gravity separation process to form two separate streams of gas and liquid for separate measurements of their flow rates.

U.S. Pat. No. 4,874,359 to White et al. describes a medical infusion apparatus incorporating a bubble trap.

U.S. Pat. No. 4,900,308 to Verkaart describes an air elimination device including a vertically-oriented column configured to provide a downward flow velocity for a fluid which is less than the rate at which a bubble of gas to be removed will rise through the fluid.

U.S. Pat. No. 4,940,473 to Benham describes a separator and de-gassifier for a recirculating hot water system having a vertical reservoir divided into upper and lower chambers. Vortex flow is induced to cause gas to separate and rise.

U.S. Pat. No. 5,061,236 to Sutherland et al. describes a blood reservoir device having filter elements to facilitate removal of air from blood.

U.S. Pat. No. 5,152,964 to Leonard describes a membrane blood oxygenator for adding oxygen and removing carbon dioxide from blood and replacing the blood in the patient. Pressure of the blood and gases is controlled to avoid formation of gas bubbles.

U.S. Pat. No. 5,188,604 to Orth describes an extra corporeal support system incorporating a blood treatment device such as an oxygenator.

U.S. Pat. No. 5,228,889 to Cortial et al. describes a device for eliminating bubbles of gas from a liquid using buoyancy.

U.S. Pat. No. 5,429,595 to Wright, Jr. et al. describes a safety air diverter for preventing the introduction of air into the arterial line during open heart surgery.

U.S. Pat. No. 5,486,162 to Brumbach describes a bubble control device for an ultrasonic surgical probe using a restricted passage to reduce bubbles in fluid.

U.S. Pat. No. 5,503,801 to Brugger describes an apparatus for trapping bubbles in blood flowing in a circuit using redirection of blood flow to provide an opportunity for bubbles to separate from the blood.

U.S. Pat. No. 5,531,119 to Meyers describes an ultrasound probe housing having at least one bubble trap disposed therein. The bubble traps use fluid expansion compensation chambers to capture bubbles.

U.S. Pat. No. 5,537,335 to Antaki et al. describes a fluid delivery apparatus in which pressure waveforms are produced which mimic the pressure waveforms of the human circulation system.

U.S. Pat. No. 5,582,633 to Jiang et al. describes a water management system which removes water vapor from the analyte slug that is desorbed from the trap. Swirling flow is created to remove water vapor.

U.S. Pat. No. 5,591,251 to Brugger describes an apparatus for trapping bubbles in blood flowing in a circuit, including a chamber divided into upper and lower subchambers. Deflection and redirection of blood within the chamber provide an opportunity for gases in the blood to separate from the blood.

U.S. Pat. No. 5,632,894 to White et al. describes a blood filter arranged to induce vortex flow for release of entrapped air through a top vent offset from the central axis.

U.S. Pat. No. 5,674,199 to Brugger describes an apparatus for trapping bubbles using redirection of flow to provide an opportunity for bubbles in the blood to separate from the blood.

U.S. Pat. No. 5,707,431 to Verkaart et al. describes a gas elimination device for cellular fluids arranged to create a vortex flow. The separation of gas bubbles is caused by both the centrifugal forces in the vortex and the buoyancy of the bubbles.

**References Discussed in the Specification**

Copies of the following references, which were discussed in the specification of this application, are enclosed: U.S. Pat. No. 4,368,118 to Siposs; U.S. Pat. No. 4,388,922 to Telang; and U.S. Pat. No. 5,451,321 to Matkovich.

**References cited in Assignee's Other Pending Applications**

The following references were cited during prosecution of another application, USSN 08/934,908 filed 9/22/97, that is assigned to the assignee of the present application and pertains to a blood gas separation device:

U.S. Pat. No. 2,876,860 to Clark et al. describes a device for de-aerating a liquid using a hydrocyclone having in combination therewith a vacuum-influenced chamber.

U.S. Pat. No. 3,785,380 to Brumfield has already been cited in this application.

U.S. Pat. No. 4,547,196 to Bartlett describes a system for autotransfusion.

U.S. Pat. No. 5,451,321 to Matkovich is discussed in the specification of this application.

U.S. Pat. No. 3,955,573 to Hansen describes an anticoagulant delivery device forming part of an aspiration wand.

U.S. Pat. No. 3,807,401 to Riggle et al. describes an anticoagulating blood suction device for use in intra-operative autotransfusion operations.

U.S. Pat. No. 3,965,896 to Swank describes a blood autotransfusion method.

U.S. Pat. No. 5,386,734 to Pusinelli describes a centrifuge for the separation of blood into its component.

Great Britain Pat. No. 2063108, Great Britain Pat. No. 3624363, German Pat. No. 3641644 and German Pat. No. 4329385 were cited earlier in the prosecution of this application.



German Pat. No. 2621051 describes describes a cyclone device for separating liquid components from flowing gas.

German Pat. No. 29500879 describes a device for suctioning blood from the field of an operation being conducted on a living organism. An anticoagulant can be added while the blood is being suctioned up.

German Pat. No. 4326886 describes a device for suctioning up and processing blood from fields of operation. The suctioned-up blood is conveyed over baffles 17 in a vacuumized reservoir 3 in order to remove air from and hence de-foam the blood.

German Pat. No. 3222345 describes a device for suctioning up and releasing blood. The blood is suctioned up through a tube 30 with a vacuum generated by a source 28 and conveyed to a collecting vessel 15 through flexible tubing 12 provided with a flow-control clamp 11.

German Pat. No. 3448173 describes a device for autotransfusion or reinfusion wherein an anticoagulant liquid is added to the blood.

German Pat. No. 3011681 describes a device for filtering parenteral or other liquids. Is has a housing 30 with an outlet 55 for the gas to escape through.

The following references were cited in another application for U.S. patent, USSN 08/934,941 filed 9/22/97, assigned to the assignee of the present invention and relating to a method of blood-gas separation and separating device:

U.S. Pat. No. 5,411,472 to Steg Jr. et al describes a low trauma blood recovery system. The system separates liquid blood from the foam blood mixture and relatively slowly accelerating the liquid blood from substantially zero velocity at the wound site to a low velocity and moving the liquid blood at relatively low velocity and relatively high negative gauge pressure, while separately accelerating the blood foam mixture at a greater rate of acceleration and moving the blood foam mixture at a higher velocity under lower negative gauge pressure.

German Pat. No. 2261127 describes a gas trap for liquids like blood flowing through a line. The blood flows through one chamber 18 so turbulently that the bubbles separate out and float up to a gas-collecting connection 20 in another chamber 24.

WIPO 92020380 to Adhoute describes a per-operational autotransfusion suction device having a suction cannula.

The following were all discussed above or earlier in the prosecution of this application: U.S. Pat. No. 3,785,380, U.S. Pat. No. 2,876,860, U.S. Pat. No. 4,547,196, U.S. Pat. No. 5,451,321, GB 2063108, German Pat. No. 3624363, German Pat. No. 3641644, German Pat. No. 4329385, German Pat. No. 2621051, German Pat. No. 29500879, German Pat. No. 4326886, German Pat. No. 3222345, and WIPO 92020380.

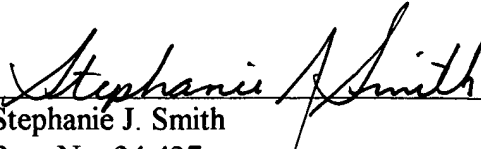
The Applicant brings to the Examiner's attention USSN 08/571,490 filed 12/13/95 for which a Notice of Allowance has been issued and the issue fee paid, which is assigned to the assignee of the present application and which relates to a cyclone apparatus for removing air from air-containing blood. All references cited during the prosecution thereof have been cited above, in the specification of this application, or previously in the prosecution of this application. They are: U.S. Pat. Nos. 3,785,380, 5,451,321, 4,388,922, and 4,368,118, GB 2063108, Ger. Pat. No. 3624363, Ger. Pat. No. 3641644, and Ger. Pat. No. 4329385.

**Search Report**

A copy of the search report for the German application from which the present application claims priority is enclosed.

Respectfully submitted,  
KEVIN BUSINESS CORPORATION  
By its attorneys:

Date: 8/24/98

  
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